

In the Claims

45 to 75. (cancelled)

76. (previously amended) A system for introducing an additive into a viscous medium comprising:

a conduit having an inlet and an outlet;

means for introducing a viscous medium into said conduit inlet;

an injector having a nozzle with an axially extending bore therein, said nozzle having a nozzle passage with a nozzle outlet in fluid communication with said conduit and an inlet in fluid communication with said bore, a needle extending axially within said bore and having valve means associated therewith for controlling fluid communication of said bore with said inlet of said nozzle passage as a function of the axial position of said needle in said bore;

a pressure regulator for controlling the pressure of an additive in said bore and the viscous medium in said conduit;

actuating means for axially moving said needle in said bore in response to an electrical signal in a cyclical manner from a first position whereat said nozzle passage inlet is closed to a second position whereat said nozzle passage inlet is in fluid communication with said bore to a set degree, said movement from said first position to said second position occurring at a set frequency and at a set time for said second position whereby said additive is pulsed into said medium.

77. (previously added) The system of claim 76 further including mixing means in said conduit downstream of said nozzle for causing the direction of said medium with said additive to change promoting mixing of said medium with said additive.

78. (previously added) The system of claim 77 wherein said mixing means includes a static mixer in said conduit.

79. (previously added) The system of claim 77 wherein said mixing means includes a plurality of longitudinally spaced obstructions within said conduit downstream of said nozzle.

80. (previously added) The system of claim 77 wherein said mixing means includes a longitudinally extending channel within said conduit having a channel inlet and a channel outlet, said channel having a longitudinally- extending portion thereof of increasing cross-sectional area in the direction of said channel outlet and said nozzle adjacent said channel inlet.

81. (previously amended) The system of claim 77 wherein the diameter of said nozzle passages is between 0.08 and 0.2 mm and said pressure regulator is set to establish a higher additive pressure in said bore than said melt in said conduit whereby said nozzle passages act as orifices.

82. (previously added) The system of claim 81 wherein said nozzle bore has a nozzle seat formed therein upstream of said nozzle passage inlet and said needle has a valving surface adjacent said nozzle seat for opening and closing said nozzle seat as a function of axial position of said needle in said bore.

83. (previously added) The system of claim 82 wherein said valve seat has sharp edge surfaces whereby atomized spray exits from said nozzle passage outlet into said medium.

84. (previously added) The system of claim 82 wherein said nozzle has a plurality of nozzle passages circumferentially spaced about said nozzle at set inclined angles relative to the longitudinal direction of said nozzle.

85. (previously amended) The system of claim 83 wherein said nozzle has a pocket at an end thereof and through which said nozzle passage extends, said valve seat being disposed upstream of said pocket whereby discrete drops of additives may be injected into said medium upon opening and closing of said nozzle with said valve seat.

86. (previously added) The system of claim 81 further including said needle having a needle bore axially extending therein; said needle having orifice passages adjacent the tip of said needle in fluid communication with said bore in said nozzle and a needle valve is said needle bore movable within said bore to open and close said orifice passages; and said actuator means controlling said needle valve and the position of said needle independently of one another.

87. (previously added) The system of claim 86 wherein said needle valve is an interior needle within said needle bore and said actuator means effective to move said interior needle within said needle bore to open and close said orifice passages and said regulator effective to supply pressurized additive to said needle bore and pressurized medium to said bore between said nozzle and said needle.

88. (currently amended) The system of claim 77 further including an extruder plasticating screw within an extruder barrel for forming said medium as a plastic melt, said regulator controlling the rotation of said extruder screw and the temperature of said barrel to control the pressure of said melt, said extruder barrel having a space forward of said screw for receiving said melt terminating at an extruder nozzle, a die mold adjacent said extruder nozzle and melt channels between said nozzle and said mold or within said mold, said additive selected as at least one element from the group comprising consisting of gas producing substances, dyes, hardeners, softeners, fillers, blends and reactants and said conduit comprising at least one element selected from

the group comprising consisting of said forward space, said melt channels and said die mold.

89. (currently amended) The system of claim 77 further including a reciprocal in-line injection molding plasticating screw within an injection barrel for forming said medium as a plastic melt, said regulator controlling the rotation and translation of said screw and the temperature of said barrel to control the pressure of said melt, said barrel having a space forward of said screw for receiving said melt terminating at an injection barrel nozzle, a mold adjacent said injection nozzle, at least one hot runner between said mold and said injection nozzle and melt channels within said mold, said additive selected as at least one element from the group comprising consisting of gas producing substances, dyes, hardeners, softeners, fillers, blends and reactants and said conduit comprising at least one element selected from the group comprising consisting of said forward barrel space, said melt channels and said hot runner.

90. (currently amended) The system of claim 77 further including a casting machine for producing said medium as a molten metal, said metal flowing in a valved passage to a die mold, said die mold having melt channels within said mold, said additive selected as at least one element from the group comprising consisting of alloys and metallurgical additives, and said conduit comprising at least one element selected from the group comprising consisting of said valved passage and said melt channels.